March-April, 1956

MOTOROLA newsgram

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Communications and Electronics Division.

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Let's Have a Visit

I note that in the year-end statement by George C. McConnaughey, Chairman of the Federal Communications Commission, he refers to the "housing shortage" in some parts of the spectrum. He states that at year-end there were 1,400,000 radio authorizations on the FCC books. Sixty different kinds of services were involved, with over 800,000 fixed and mobile transmitters, and 1,100,000 permits of different grades to operate them. The Chairman's report also refers to 2,800 AM broadcast stations in operation and 500 TV stations on the air.

Now, let me quote directly from Chairman McConnaughey's statement: "The accelerated expansion of wire and radio services plus the complexities of new technical developments has multiplied regulatory and administrative burdens accordingly. In the past five years, the Commission's workload has more than doubled. Yet, in fiscal 1955, it had to do the job with about the same money, but with less personnel than it had any year since World War II.

"In consequence, its personnel of less than 1,100 is hard pressed to keep up with the nearly 10 billion electronics industry, perform its share of regulating a 16-billion telephone industry that has tripled in size since 1940, and administer to a broadcast industry whose annual revenues now exceed one billion."

Perhaps you will understand the implication of the statement I have quoted. The pressure on the radio spectrum is increasing. The demand for space by all services is substantial and impossible to fill. Since we are particularly concerned with the impact of Commission activity upon the mobile services, let us consider that the expansion of our radio systems must be accomplished by two possible means: (1) By subdividing the spectrum into narrower and narrower channel slices. (2) By changing from a national countrywide system of frequency allocations to geographical area allocations.

Splitting and re-splitting the channels will bring us very quickly to a condition of diminishing returns. The wide band FM system of modulation provides superior signal-to-noise ratio, and proportional degradation of signal accompanies a reduction of the bandwidth. While it has been adequately demonstrated that practical systems can tolerate bandwidths of 20 Kc. and somewhat less, it is also true that the spectrum population is not determined exclusively by the channel width of the transmitted energy. Intermodulation and desensitizing in the receivers are design limiting factors which quickly vitiate the apparent gains associated with excessive channel splitting. Single sideband transmission has been supported by some engineers as the cure-all for spectrum crowding, but here, too, the signal is susceptible to jamming, and intermodulation and desensitizing are still important limiting factors in multiple systems operation.

We all know *what we need* to make channel splitting really practicable. Desensitizing and intermodulation are produced by unwanted signals affecting either the r. f. amplifier or mixer circuits of the receiver. What we need is *r. f. selectivity* which will provide the same discrimination against adjacent channel signals as we now have in our i. f. filter design. In the present art, such selectivity at r. f. frequencies is impossible. Neither precision cavities nor crystal filters come anywhere near the selectivity characteristic required. While it is possible to build special crystals to reject particular frequencies, or to use special cavities to influence some patterns of intermodulation, there is nothing in the art which gives promise of the development of an r. f. filter which would accept even a 60 Kc. channel while rejecting the adjacent channels in a manner comparable to that accomplished at the intermediate frequency level. We need a new principle which is neither coil, cavity nor crystal.

Geographical allocations offer the best potential for immediate expansion of the spectrum. By geographical allocation, we imply that frequencies not needed and unused by a service in a particular area would be re-allocated to other services needing them. It doesn't seem logical that 60 channels allocated for the use of a service in one area should be held exclusively by that service barring all other users, when only one channel is needed and only one channel will be used. The application of area allocation would release 59 channels for other users.

The reason why the FCC has not explored the logical geographical allocation pattern and put it into use is explained by implication in Mr. McConnaughey's statement quoted above. The geographical allocation of frequencies will require substantially more administrative supervision than the blanket national allocation plan. Experts are needed to study the pattern and to evolve a formula for issuing the frequency assignments. Additional clerical personnel will be needed to check the individual area assignments as each license is granted. A substantial increase in the FCC staff must be accomplished before geographical allocation can be put into use.

We must realize that our right to continued use of the spectrum will be challenged if we do not constantly increase the efficiency of such utilization. The pressure upon the spectrum space by the military, the common carrier service, and the broadcast services will challenge the use of the frequency allocations assigned to the mobile services. We all know the vital importance of the mobile services to the safety services, and to the national defense of our country. The multitude of the independent services covering the country provide the only real emergency communication service which will continue to function for civil defense in time of war or national disaster. The healthful competition among the manufacturers and among the systems users stimulates work to insure constant improvement of the most effective mobile communications equipment in the world and trains maintenance men and efficient operators to keep the systems functioning.

The principle of dispersal is embodied in the pattern of the multitude of independently operated and owned mobile radio systems located almost in random geographical distribution. This multiplicity of systems in geographical dispersal promises that bombs, hurricanes, or earthquakes may knock out some of the systems, but others will remain to perform the vital communication function which is the first requirement for effective rescue operations.

There are a great many important people in the United States, including senators and congressmen, who do not know about the magnitude and the potential importance to the country of the two-way mobile radio industry. I think we should take time out to educate our representatives in Washington to the necessity for supporting the Commission in its request for adequate funds to do the essential administrative job of fostering a maximum effective use of the radio spectrum. Without FCC control, we would have chaos. Without funds to support an adequate FCC staff, we shall develop an increasing condition of stagnation and confusion produced by the unavoidable bottlenecking of every creative idea for increasing spectrum utilization. I think each of us should write his senator and his congressman to explain the vital importance of providing adequate funds, so that the Federal Communications Commission may fulfill its responsibility to you, to me, and to the people of the United States.

Sincerely,

Dan Noble

The MOTOROLA NEWSGRAM

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Technical Information Center

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Motorola Awarded $1.9 Million Contract For Military Microwave Relay Equipment

Receipt of a contract from the U. S. Air Force amounting to more than $1,900,000 for military microwave relay equipment has been announced by Daniel E. Noble, vice president in charge of Motorola's Communications & Electronics Division.

The Air Materiel Command contract calls for production of three types of relay equipment—one for transmitting information from search and surveillance radars to provide a remote display, one for two-way transmission of voice messages over microwave channels, and one to provide complete remote reporting from an early warning radar site of search radar, height finder radar and IFF information. The last type of equipment also transmits necessary control information to permit complete remote control of the radar sets.

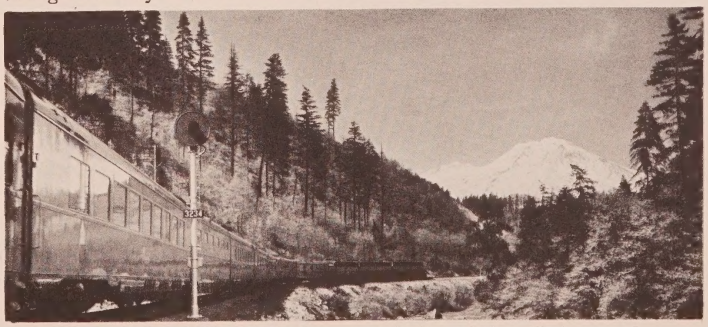
Motorola designed and developed all three types of military microwave relay equipment under previous Air Force contracts. The Company's new Chicago microwave plant will be utilized for manufacturing of equipment under the present contract. » » »

SOUTHERN PACIFIC TO INSTALL MOTOROLA MICROWAVE

The Southern Pacific Company has received approval from the FCC to construct as its first microwave system a four-hop link bridging 23 rail miles between Dunsmuir and Black Butte, Calif. This particular stretch is located in a mountainous area of heavy snow falls and strong winds. The need for dependable communications is especially urgent because all traffic on the Shasta route linking San Francisco and Portland is routed through it.

Motorola will supply all of the microwave equipment in duplicate to provide 100% stand-by, with automatic transfer facilities. The system will have an ultimate capacity of 120 voice channels, although initially it will consist of eight channels to handle VHF radio control, Teletype, train dispatcher telephone and various control and alarm circuits.

Especially interesting about the microwave system is the fact that it will employ two passive repeaters in addition to the two terminal stations and one electronic repeater. Passive repeaters require little maintenance and consume no power, qualities made desirable by the nature of the terrain and weather. The microwave signal will be beamed from Dunsmuir to a hill-top passive reflector, then direct to an electronic repeater at Mt. Shasta; from there to another passive reflector on a hill top, and then to the Black Butte terminal station. » » »



SHASTA DAYLIGHT takes curve in its twisting climb toward base of Mt. Shasta, scene of SP's first mainline microwave system.

Portland's Police Chief James Purcell, Jr. is currently testing Motorola QUIK-CALL Signalling equipment.

TWO-WAY RADIO:

MUNICIPAL WORKHORSE

Since two-way radio is so valuable in police and fire work, there is no reason why it shouldn't be used to greatly increase the efficiency of other city departments using vehicles. That's the theory expressed by city officials in Portland, Oregon where two-way radio is taking on more importance in municipal government.

Portland's approach to communications is businesslike, with an independent Bureau of Communications & Electronics set up to administer all radios, telephones, intercommunication sets, paging and public address systems—in fact, all electronic devices.

Supt. Cal Mulanax uses his HANDIE-TALKIE portable radiophone to talk over a P. A. system.

The C & E Bureau has a master radio plan for five systems with city departments grouped in the several systems according to function performed. These are the Public Works, Police, Fire, Water Bureau, and Miscellaneous Systems. Channels have been assigned in the 150-160 mc. band with separate dispatch points. The police share their channels with Public Works and Miscellaneous Services.

The C & E Bureau handles communications up to the point of actual dispatching and keying the equipment. The user departments do their own dispatching in the manner they feel best suits the peculiar requirments of that department. Hence each department has complete control over his radio system.

This method eliminates usual municipal problems such as the police dispatcher handling all calls to the Health Department automobiles or Water Bureau trucks. The five-channel arrangement is expected to satisfy Portland's radio needs for years.

A major advantage of the system's grouping is the ease with which a city department can begin, expand and re-arrange its radio operation without disrupting other departments. This is especially important, for Portland is in the process of gradually replacing its low-frequency AM police equipment with Motorola FM radios operating in the 150 mc. band. During the transition period, police dispatchers talk out on both low-band (39.74 mc.) AM and high-band (159.21 mc.) FM transmitters to the department's 165 mobile units.

The Public Works system, operating on 155.190 mc. with the main dispatch point at the police headquarters and a secondary dispatch console at the engineers' headquarters, consists at present of about 25 mobiles and one main base station. Public Works shares a police channel which is mostly utilized at night by specialized detective squads. The department rates the radios as a boon to efficiency in everyday use, and indispensable in emergencies.

The Water Bureau radios, on 153.71 mc., serve a dual purpose. Along with routine messages to service trucks, the dispatcher keeps in radio contact with water supply engineers 30 miles east in the Cascade Mountains from which Portland draws its water.

When wire lines fail, Dispatcher Laverne Belger uses the Water Bureau radio to communicate with water supply engineers 30 miles away.

Portland's Mayor Fred L. Peterson, left, and Commissioner Nate Boody, head of the Communications and Electronics Bureau, inspect the radio in His Honor's car.

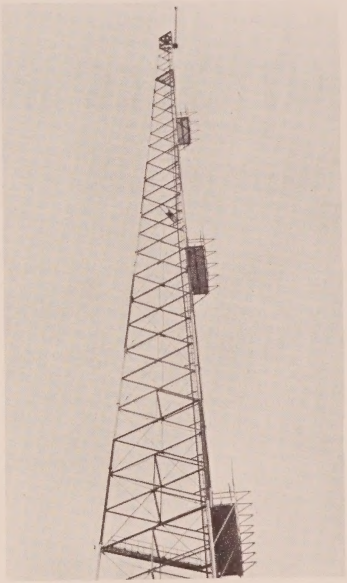
Among the 90 mobiles operating on the city's fire frequencies of 154.01 mc. FM and 33.98 mc. AM are three fire boats on the Williamette River. Here is practiced radio remote control at its best—fire boats hurling powerful streams of water at targets out of sight to the boat crews, directed from a mobile unit near the blaze.

Portland's independent Communications Bureau is highly successful because the bureau chief Temple V. Ehmsen and his staff of seven technicians take a "can do" attitude toward the various departmental requests. For instance, the police had urgent need for several mobiles to work on an uncrowded frequency for special stake-outs. The C & E Bureau quickly supplied the communications by assigning the 18 FM converted police cars to the stake-out detail and leaving the AM units in normal service.

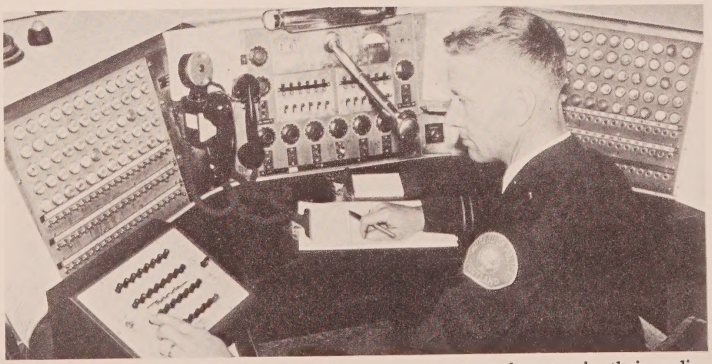
Similarly, the Health Department asked for radio contact with its two airplanes used for anti-mosquito fogging. The radio technicians obliged by installing antennas and providing portable radiophones in the planes.

With completion of a new 1,445 foot high antenna, the C & E Bureau expects to start Portland's fifth city radio system, a catch-all channel operating on 156.15 mc., to provide coverage to traffic radar cars, specialized night police services, Park Bureau, Traffic Engineering, Sewage Disposal and Health Departments. As Ehmsen says, "We will probably find several other departments that need two-way radio on this channel, too. New uses are turning up every day." »

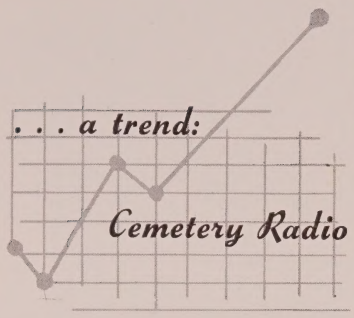
A 500-ft. mast atop Council Crest Mountain serves the radio systems of the City of Portland, County Sheriff, and Multnomah County Road Dept.



Technicians Art Cameron and Gene Jacobson are two of the seven radiomen who install and maintain the city's nearly 400 transmitters and receivers.



Police Radio Dispatcher contacts officers who are near, but not in their radio-equipped cars, by means of Motorola QUIK-CALL selective signalling apparatus.



HOW A MODERN INTERMENT PROCEDURE

When a grave must be dug hurriedly the foreman is flashed by radio, and sends machine to new assignment. Before radio the office had to hunt for the foreman.

UTILIZES MOBILE COMMUNICATIONS

Historically, cemeteries have made many attempts to solve the problem of office-to-field contact.

This has been true at Mt. Carmel Cemetery in Hillside, Illinois, where once, long ago, a church bell on top of the main office building was rung to summon cemetery foremen. Later, a large public address system was installed on a water tower, with supervisory personnel responding to their own musical code—the first three or four notes of a particular hymn.

Both of these methods, however, conveyed only the rudimentary information that a certain person was wanted by the sexton's office. Neither provided any way for personnel in the field to contact the office.

Outdated communications methods such as these could not even begin to cope with the busy pace of activity that exists today at Mt. Carmel and nearby Queen of Heaven Cemeteries.

There are, for example, some 50 distinct activities involved in a single burial, most of which require close cooperation and frequent exchange of information between the office and field foremen.

Multiply this by twelve—the average number of interments each day—and you have a good idea of the tremendous volume of details which must be handled swiftly, unobtrusively and without a hitch at this large modern cemetery.

Quite clearly, there is a communications problem involved. But because the individuals who coordinate these details are normally scattered throughout the sprawling expanse of grounds, the problem is a specialized one whose only satisfactory solution appears to be 2-way radio.

In 1952, when the rate of interments had risen to the point where field and office staff encountered increasingly difficult communications situations, the cemetery turned to mobile radio as a possible answer. Several makes of equipment were tested, and finally Motorola 2-way units were selected on the basis of performance reliability.

The system consists of a base station at the Mt. Carmel main office, which also handles maintenance operations in Queen of Heaven Cemetery across a U. S. highway to the south, together with mobile radios in three supervisory automobiles. One is used by the Assistant Sexton, and the other two by the Interment Foreman and the Maintenance Foreman.

Licensed by the Federal Communications Commission as a Low Power Industrial system, the radio units operates on a frequency of 157.57 mc.

Since this system was installed four years ago, separation of key supervisory personnel has ceased to be a problem, although in pre-radio days as much as an hour often was spent trying to locate an individual in the several hundred acres of grounds then developed. The developed area today is about 500 acres.

Obviously, the chief benefit of 2-way radio is the saving of time, which also means that with the same effort the personnel can do more work.

But what are the specific advantages? On several occasions Mt. Carmel has had over 20 funerals in a single day—once 25—and these peak periods afforded dramatic evidence of the value of radio communications, advantages such as the following:

1. Instant transmission to the field force of changes in burial

instructions, cancellations and similar information.

2. Ordering grave-side rain tents. A special truck carrying eight tents is kept ready at all times. When it leaves the maintenance building it cannot respond to incoming tent orders without the assistance of the foreman who leads the way in his radio-equipped automobile. Thus, those attending funerals are not kept waiting in their cars, but find their tent erected when they reach the grave.

3. Handling last-minute interment orders. After long holiday week-ends the cemetery frequently receives a flood of last-minute orders, and 2-way radio makes it possible to quickly expand working capacity to handle them smoothly. Once a funeral director's office neglected to place an order for grave preparation. At 10 o'clock the morning of the funeral Mt. Carmel received a hurried call from the director, saying that the funeral would arrive an hour and 15 minutes later. There is a field force of 76 workers, an office and supervisory staff of 13, and many thousands of dollars worth of specialized office and field equipment—including grave digging machines—but without 2-way radio there would not have been enough *flexibility* of movement to handle such a monumental task on such short notice.

4. Notifying field foremen of the arrival of off-hour funerals, or of the arrival of suppliers' delivery trucks.

5. Arranging with field foremen to show a particular lot or grave to families or visitors.

Foreman reports work status to sexton's office over his two-way radio.

Ralph M. Torgersen, Mt. Carmel Sexton, verifies a grave lot location in response to radioed query from foreman. Radio speeds operations by permitting instant checking of essential information.

6. Checking complaints.

7. Snow clearance orders. During the winter the office notifies the field force which routes must be cleared of snow. Sometimes more than a mile of snow-covered road must be cleared for a single cortege, and there are approximately 25 miles of roadway in the two cemeteries. Just as often, foremen radio into the office which roads have been cleared of snow, since routine maintenance —75% of a cemetery staff's work —also requires clearance.

In the above applications radio contacts usually are originated by the sexton's office. Radio not only eliminates notes, memos and other paper work, but also frees the office staff from the task of hunting foremen in the field to give them essential information.

Radio has also made it possible for information to flow quickly from the field to the office. Some of the ways this improves our service are as follows:

1. Notification of lot selections. A representative of a family often visits numerous locations before making a selection, which in some cases requires confirmation by the sexton's office before being considered final. Radio eliminates delays and trips to and from the grounds during these selections.

2. Delivery of vaults. When the maintenance foreman learns—by his radio—of the arrival of such a truck at the main gate he simply flips his microphone button and informs the office of the best route to the delivery site.

3. Checking on delayed funerals. Radio contact enables the foreman to query the office when a funeral is late, with the result that frequently a waiting field crew can be released for other urgent work. When the funeral finally arrives, the sexton's office can radio the foreman, who then dispatches another crew to the assignment.

4. Ordering emergency repair parts for machines and equipment, or additional supplies needed immediately.

5. Obtaining information from the office relative to previous burials, or interments in adjacent lots, etc. Such information often is requested by members of a family visiting the cemetery, and is likewise needed by the foremen in complying with burial instructions.

Other important uses for 2-way radio are discovered from time to time. For example, in recent years there has been an increase in automobile traffic congestion, particularly on peak days or when a well-known person is being laid to rest. Radio-equipped vehicles are invaluable in avoiding and clearing such congestion.

In Notes and Quotes magazine, published by the National Catholic Cemetery Conference, Joseph Walsh, Director of Services, The Catholic Cemeteries, said: "The savings in man hours, the greatly expedited service, plus the inestimable value to both office and field of quickly dispatching instructions and assignments, leaves no doubt of the value of a radio communications system such as ours." » » »

Radio Clicks on Route 66

Concrete pouring operation benefits heavily from 2-way radio. Batching plant loading can start, increase, decrease or stop as conditions warrant.

MOBILE COMMUNICATIONS . . .

Speeds Highway Construction

Twenty minutes conversation by 2-way radio with the earth-moving, paving, batching plant, maintenance and other foremen provides a more complete summary of working progress than half a day spent running up and down the highway in a supervisor's car.

That's the conclusion of Robert V. Cave, Secretary of the Standard Paving Company, Chicago, whose firm completed a 24-mile construction project on U.S. Highway 66 near Pontiac, Illinois, in 1955.

Naturally, special problems still require the superintendent's personal inspection of job sites every day. But the travel involved is only a small fraction of that done in the "old days" when there was no radio, and it was necessary to travel the spread constantly just to keep informed of progress.

A great deal of this needless travel was avoided by using radio on the 24.7 mile Route 66 job, which ran from Chenoa to a point south of Dwight. The job was to convert the two-lane road into a modern four-lane, dual-road highway separated by a grassed median ditch.

In addition to grading, subbasing, paving and shouldering the contract called for some Class X structures such as culverts and bridges. The company established its own concrete dry-batching plant at Odell. Seeding and sodding was subcontracted.

The job had hardly got underway in the spring of 1955 when it became obvious that the unusual length of the spread was creating a tough communications problem. There was an excessive amount of travel in order to supervise.

Two-way radio had been under consideration for some time, but now, the company concluded, was the time to take advantage of its capabilities.

An FCC license to operate a Special Industrial radio system was obtained, and two base radio stations and 9 mobile radio units were installed in June.

One of the base stations was at the field office, a trailer off the highway at Pontiac. The other was at the Odell batching plant. The mobile units were installed in passenger cars used for supervision, and in pickup trucks used for maintenance and general utility purposes.

Operating under call letters KSE 242, this 43.02 mc. Motorola 2-way radio system provided perfect communications throughout the 24-mile-long spread at all times.

Standard Paving's men were so intrigued with the novelty of mobile radio that they immediately became 100% boosters of the new communications medium. After the first week or so, when the novelty wore off a bit, they also began to realize how much it improved the way they did their jobs.

The company noticed a substantial improvement in overall operating efficiency from the first day. Here are the high points:

1. **Total, Instantaneous Supervision.** The superintendent can't be everywhere at once, but his voice is. When he is in the field he can always be reached instantly. When he is at the office the foremen are right at his fingertips. A quick radio call brings in essential job information in just seconds . . . . instead of the hour

or so required to send a man out in a truck to get it.

2. **Perfect Organizational Control.** When men and equipment are moved or work schedules altered, mobile radio provides tremendous new flexibility and freedom to accomplish the task swiftly and easily. When special problems arise that require conferences between various foremen, they get together and settle it over the radio in a few minutes. Sudden material shortages are reported instantly, thus avoiding needless delays. *The savings in time and labor costs that result from all this are enormous!*

3. **Fast Maintenance.** Mechanics now can order repair parts immediately upon inspecting a machine breakdown, instead of spending an hour or two traveling to get the parts themselves. Once hard to locate, the mechanics now are easy to find by radio. And they work more efficiently, cleaning up all the little jobs in the vicinity before moving to other maintenance jobs in another part of the spread—no backtracking.

A good example of how radio-on-the-move helps maintenance occurred one day just before quitting time. A grader broke down and the foreman radioed for a mechanic. He arrived in three minutes, spotted the trouble, and in less than five minutes was on the radio himself telling the field office what parts he needed.

The parts jobber in a nearby town was notified just as he was leaving for the day, and agreed to drive the parts to a drop point. A truck picked up the parts and brought them to the mechanic, who had the grader rolling again in about an hour, ready for work the next morning.

Before mobile radio the mechanic would not have known about the grader breaking down for at least half an hour. By then it would have been too late to order the parts that night. The machine would have been out of operation until the middle of the following day, waiting for parts and repair. Mobile radio saved at least 6 hours working time on that earth-mover, and there were numerous other occasions when it speeded up maintenance of critical equipment.

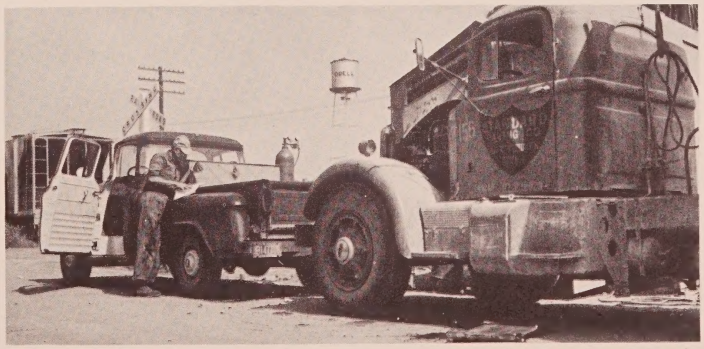
Mobile radio also improves efficiency between paving crews and the batching plant. Need more concrete fast? Less? Stop for rain? A break down? Need one more load? Merely by pressing a microphone button and talking the foreman can save tons of concrete and dozens of man-hours of overtime.

The secret of successful highway construction is efficient *organization.* Mobile radio, perhaps more than any other equipment, is responsible for putting Standard Paving's operations on a new and higher level of effectiveness.

In 1956 the company started another big contract on Route 66 and again is relying on Motorola 2-way radio to keep things going fast and smoothly. » » » » » »

Field office manager R. A. Buenker listens to a mobile unit reporting in by radio as his wife, radio dispatcher, stands by at the microphone.

When earth-mover broke down, 2-way radio got it rolling again in less than an hour. Before radio was installed troubles like this could eat up half a day.



Mechanic Vic Burris, microphone in hand, saves time by reading list of needed maintenance parts to base station, which will order them from jobber immediately.

... a step forward

Midway Airport where American Airlines has 82 incoming and an equal number of outgoing flights daily.

Mobile Radio Controls Airline Baggage Handling

Driver gets changes in pickup orders by radio, enabling him to give priority handling to urgently needed bags.

At Chicago Midway Airport, American Airlines handles over 6,000 pieces of luggage a day without mishap. Yet, just two years ago as many as 12 bags a day went astray.

This frequently resulted in late departure of a flight—a serious matter in airlines operations. Or it was a source of concern and inconvenience to passengers whose bags were sent along on the next flight.

A study of the problem was made, which showed that American's baggage operation involved three types of handling:

1. Bags traveling exclusively on American. This includes luggage belonging to "through" passengers who transfer from one American flight to another, as well as baggage for boarding and terminating passengers.

2. Luggage arriving on American which must be transferred to outgoing flights of other airlines.

3. Bags which must be transferred from incoming flights of other airlines to outgoing AAL Flagship flights.

In the first group of exclusively American luggage, about 4,000 pieces are handled per day. Since these are always under control they were not the source of the stray luggage difficulty.

Of the remaining 2,000 bags, about half fall into the second category, delivery being made to the other airlines by American.

The other 1,000 bags, the third group, are delivered to American by other airlines at Midway Airport. There was never any difficulty or delay in the delivery of the 700 or so of these pieces which were handled with sufficient time allowance; the trouble arose in handling the 300 bags that had to be moved on a very tight schedule, usually with only a few minutes between arrival of the incoming flight and the scheduled departure of the AAL Flagship.

It should be clearly understood that the interline baggage transfer difficulty that American once had in no way reflects unfavorably on the baggage operations of the other airlines at Midway Airport, which are fully as well-managed as those at American Airlines. While it was true that circumstances—often beyond their control—contributed to the delayed

handling of a small fraction of American's daily baggage volume, it was equally true that late deliveries by American caused similar inconvenience to them.

Recognizing that **lack of control** was at fault, American decided to assume full responsibility for the handling of the 300 "tight schedule" bags and send its trucks direct to the ramps of other airlines to meet incoming flights.

However, such a procedure would make it difficult to contact the baggage trucks as they roamed throughout the large terminal ramp areas. American Airlines decided to take a tip from industrial materials handling and install a 2-way radio system to permit close dispatching of the trucks. Motorola mobile radios were put in two of the interline panel trucks, and a base station was installed at the dispatcher's desk in the bag room.

A new, accelerated interline bag handling plan began to evolve. It was decided to "pre-expedite" all interline bags arriving within approximately 20 to 25 minutes of departing American flights. This means that the bag room radio-dispatches panel trucks to the other airlines to pick up and deliver these interline bags to departing American flights. The dispatcher, microphone in hand, can radio additional information as the driver makes his pre-expediting rounds.

For example, if the truck is enroute to a particular ramp and the dispatcher learns that the flight is a few minutes behind schedule, he can radio the driver to pre-expedite bags from the other lines first. When the time interval is more than about 25 minutes, the other airlines deliver the luggage in the usual manner.

The net effect of radio, therefore, is to reduce the time required for American-bound interline bag transfers to well within the shortest scheduled connection interval . . . without additional vehicles or personnel. "Before 2-way radio was installed, we had never been able to operate with such speed and flexibility, even by making an all-out effort," the company said.

Pre-expediting alone nearly solved the baggage difficulties, but a few mis-connects still occurred which greater truck utilization conceivably could correct. It was then that an "expedite" procedure was added to the new handling plan.

Expediting is a fast-moving routine that goes into operation at the last minute. In a typical case, with a flight ready to take off, the gate man will phone to bag room dispatcher to say that several bags are still undelivered. He reads the bag check numbers to the dispatcher from his list showing what bags the flight should carry.

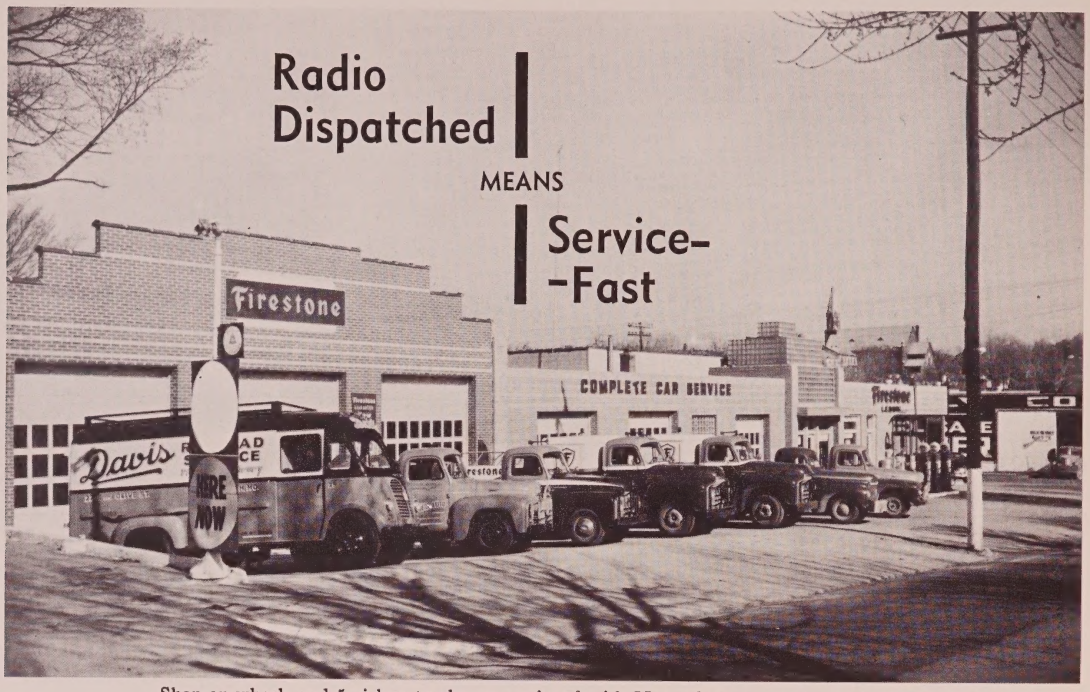
The dispatcher then radios these bag numbers to one of the interline bag trucks, which immediately picks up the missing bags and rushes them to the departing plane. Expediting late bags this way proved to be the final refinement needed to virtually eliminate the luggage headaches. The plan as a whole is so effective it's rare today for an American Flagship to be delayed because of tardy baggage, and there are 82 flights departing every 24 hours, as well as an equal number of incoming flights.

In view of this tremendous improvement in bag handling—which once was less than 70% and now is well over 95% efficient — it's easy to see why American places such great value on 2-way radio communications. Their Motorola Low Power Industrial system has made it possible to use a highly accelerated interline bag handling plan which otherwise would have been utterly unworkable. It has resulted in faultless luggage handling and the preservation of passenger good will. And American's baggage people don't worry about gray hairs so much anymore.

In a nutshell, at American 2-way radio enables them to deliver **all** the baggage—and the **right** baggage—to the **right** plane fast enough to assure on-time departures on every flight across the board, day after day.

(Left) Motorola 2-Way Radio makes it possible for American's baggage department to handle over 6,000 pieces a day without slip-up.

(Below) Interline bag truck driver gets orders from dispatcher over 2-Way Radio to "expedite" bags needed for an AAL flight about to depart.



Shop-on-wheels and 5 pickup trucks are equipped with Motorola 2-way radios for instant dispatching from Davis tire shop.

Missouri Tire Dealer Does 8-Truck Volume With Five Radio-Equipped Vehicles

The commercial tire company operating without 2-way radio is like an automobile without an engine—the only way it can go is downhill.

That's the way L. E. Davis figures it in St. Joseph, Mo., where his Davis Home & Auto Supply (with radio) has captured about 90 per cent of the roadside tire service market.

To Mr. Davis a phone call for tire service is like a fire alarm. The caller expects service in a hurry. And it is a Davis rule that a repair truck must be rolling within 2 minutes after a call is received.

"Putting ourselves in the customer's shoes, we feel that every minute drags like half an hour while he waits for our service man to arrive. Even longer if he is a truck driver with a tight schedule," says the energetic Davis, whose store, shop and warehouse now occupy almost a city block.

No Standby Crew

Davis' radios, operating on 35.70 mc under an Auto Emergency Service license, are utilized mostly to keep his five pickup trucks and a fully-equipped "shop on wheels" in close touch with the service manager. Drivers check in by radio at the completion of each job, and at all times are listening for radio orders which will send them rushing to the aid of a motorist with tire trouble.

"We formerly kept one or two trucks on standby basis at the shop, to make the emergency calls. Now, with 2-way radio on the job, we need no standby crew. All of our boys are quickly available if we need them.

"On a big job, we may dispatch three or four units to a call. Then, if another emergency arises, we pull one truck away to answer it, and return him to the original assignment without even coming in to the shop. This ability to shuffle our crews quickly is very important to our large commercial accounts which are the backbone of our business," he explains.

5 Trucks for 8

Davis estimates his radio hookup gives flexibility and increases productivity to the point that five trucks with radio do the work of eight trucks without.

His service men are thoroughly "sold" on the radios because of the ease in checking with the shop. Sometimes they will answer a call with their pickup trucks and find they lack the necessary equipment. A radio call brings the shop-on-wheels immediately, and minimizes the down-time for the customer. The

mobile radiophones also are used frequently for checking addresses, obtaining information kept in office files, and passing the major decisions back to the management for answers. Davis and his shop foremen keep a close check on operations simply by keeping an ear cocked toward the radio loudspeakers in the office and shop.

To obtain widest radio coverage, Davis installed the base station at his home, about 1.5 miles from the shop, and at a comparatively high elevation. Tip of the antenna rises nearly 100 feet in the air above a wood pole and pipe mast extension. The radio station can be controlled from his residence as well as from two remote control consoles at his business. The remote consoles also provide a private intercommunication link between shop, office and the Davis home. By pressing an intercom button, Davis can converse with his home or shop instantly, without having the message go out over the air.

Low Maintenance

In this businessman's view, one of the great surprises has been the small amount of maintenance required by the Motorola radio system. "We practically never lose a set. About the only time a unit is pulled from its cabinet is for the required FCC frequency checks. Otherwise the radios just keep perking—and our sets get pretty rough usage 'round the clock'," Davis declares.

The Motorola radio system was installed and is maintained by the Motorola authorized Service Station in St. Joseph, the Midwest Mobile Radio Service, operated by C. M. Cox. Cox notifies Davis when regular service inspections are due.

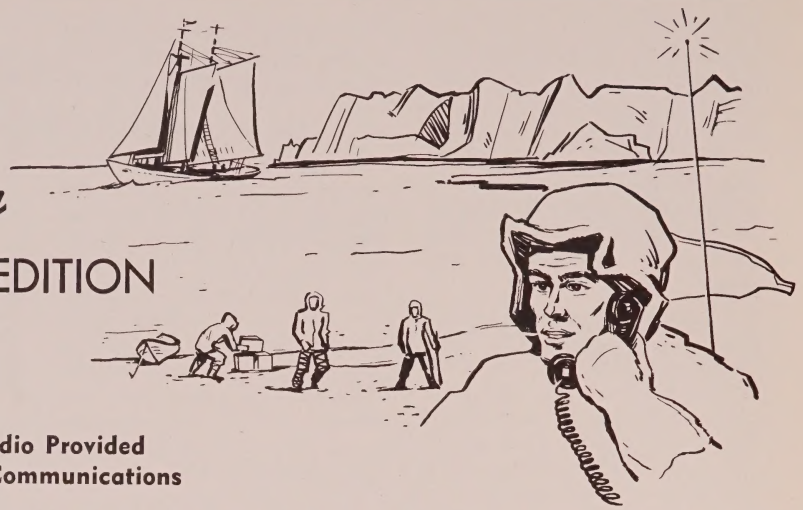
Davis' 2-way radio hook-up has drawn wide attention, both from other people in the emergency service business, and from his fellow townsmen. During the Missouri River floods in 1951, the Davis trucks provided mobile on-the-scenes communication in the rescue and evacuation operations in the lowlands west of the city. With the hundreds of other volunteers, Davis drivers worked night and day transporting families from the threatened areas and assisting with emergency levee construction. The radio equipment also is on call at the disposal of the local Civil Defense administration.

Based on his experiences, Davis rates the radios as among his most valuable business assets, having repaid their cost many times over. "To anyone in the commercial tire or battery business, I can only say 'I don't know how you get along without radio now'." » » »

Left, Radio unit on service bench links trucks with tire shop for emergency field calls.

Below, Owner L. E. Davis uses remote control console on his desk to dispatch 5 service trucks.

THE *MacMillan* ARCTIC EXPEDITION



How Motorola 2-Way Radio Provided Vital Ship-to-Shore Communications

In 1954 the world-famous explorer, Admiral Donald Baxter MacMillan, again sailed northward in the schooner "Bowdoin" on his thirtieth expedition.

It was MacMillan who did much of the important Arctic exploration which preceded Peary's successful trek to the actual North Pole site. Peary reached the pole April 6, 1909, the first man to achieve this goal.

But the 1954 expedition, like many of the more recent ventures, was for a purpose other than pushing forward the perimeter of the known explored world. The objective was to study and gather specimens of rare animal and bird life of the Arctic region on behalf of the Field, New York, and the Bowdoin Arctic museums.

The Bowdoin sailed from Booth Bay Harbor, Maine, in June, and for four months made its way northward to Labrador and Greenland, returning via Ellsmere Island and Baffinland. From time to time the Bowdoin stopped to allow landing parties to search for zoological specimens, and also hunt food for the 13-man crew.

A number of these landings were led by Dr. William A. Thomas, a Chicago physician, who is a veteran of three Arctic expeditions with Admiral MacMillan. In addition to serving as ship's doctor, he functioned as First Mate and hunter.

One of the most important pieces of equipment which Dr. Thomas and the other landing parties took ashore was a Motorola HANDIE-TALKIE radiophone, which enabled the men on shore to maintain radio contact with the Bowdoin. Another HANDIE-TALKIE radiophone was used on the Bowdoin to communicate with the shore party.

Admiral Donald B. MacMillan (right) and Dr. William A. Thomas with Motorola Handie-Talkie radiophone used to maintain vital communications with shore parties during arctic expedition.

Admiral D. B. MacMillan, famous arctic explorer and skipper of the "Bowdoin".

Even when the men on land were 8 or 9 miles from the ship perfect radio communications were established regularly every hour, on the hour.

"This gave us a great sense of security, and would have been of great benefit had there been an accident or other mishap ashore," Dr. Thomas explained. "Our portable radio also enabled us to know when to stop hunting and return to the Bowdoin because of an impending storm."

Plans have not yet been completed for the next MacMillan Arctic expedition, but there seems little doubt in Dr. Thomas' mind that Motorola HANDIE-TALKIE portable radios have earned a permanent place among essential Arctic gear. » » »

Radio contact between crews means faster, safer work.

HANDIE-TALKIE RADIOPHONES SPEED SEWER MAINTENANCE

There are over four-thousand miles of city sewers and storm drains in Los Angeles. Keeping these clean and open is a tough job that has now been made much easier and safer by the shrewd use of Motorola HANDIE-TALKIE portable radiophones.

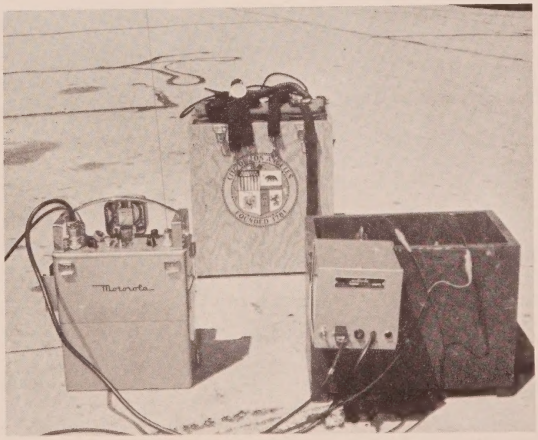
For years crews of the Sewer Maintenance Division of the City of Los Angeles have found it difficult to inspect and clean the underground lines because personnel operating equipment at one manhole were unable to keep in contact with the crew working at the next manhole. In addition to distance, the obstacles preventing easy contact were intervening buildings or the terrain itself.

Crews are further faced with a most difficult problem of cleaning in that the 55-mile long Outfall Sewer and many contributary trunk lines must cross the Los Angeles River channel through siphon structures at numerous locations. Many of these structures vary from 300 feet to 1000 feet in length, and personnel operating at each terminus of the siphon have previously found such cleaning operations most difficult and hazardous. Immediate contact is a necessity in case the cleaning tool becomes lodged in the siphon barrel being cleaned.

This necessary communications was exceedingly unreliable under our previous method of operation using hand, flag or light signals. It was often necessary to work at night to avoid road traffic and peak sewage flow periods, and there often was confusion in interpreting light signals flashed between the manhole crews.

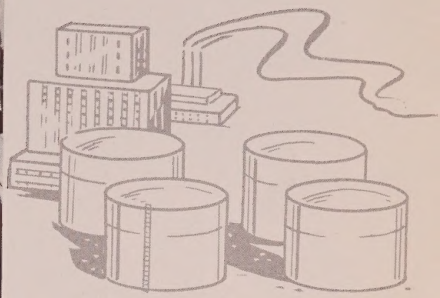
At the instigation of Alvin A. Appel, Superintendent of Sewer Maintenance, several types of portable 2-way radio units were tried out under actual working conditions. Motorola HANDIE-TALKIE radiophones proved to be most successful in actual use, and several units were acquired.

The use of these Handie-Talkie radios in the cleaning of sewers and storm drains has provided immediate communications between operating personnel, and has eliminated flag, hand and light signals entirely. The result is a big boost in the working efficiency of the cleaning crews, and a big reduction in work hazards. A good example of the effectiveness of the new radio communications is in the cleaning of the main sewer where nearby buildings do not have check valves to prevent back-flow into the building. The new procedure is to station a man with a HANDIE-TALKIE radiophone in the basement of the building, and another radio-equipped worker out in the street by the crew. As the sewer cleaning progresses the basement man keeps close watch for back-flow, and if he detects evidence of any he instantly radios the word to halt the cleaning machinery that is causing the sewage level to rise. By preventing back-flow and its costly damage to merchandise stored in basements of commercial buildings the radio equipment —in this one instance alone—paid for itself many times over. »



Motorola portable radiophone (left) with auxiliary power supply (right) for operation from 6-volt storage battery conserves the built-in dry batteries during fixed location operation.

Maintenance Supt. Ted Sullivan keeps abreast of refinery operation via 2-way radio in his company sedan while moving about the 900-acre refinery.



Four Major Uses For Radio In The Refinery

There is an object lesson in automation at the ultra-modern refinery operated by General Petroleum Corporation in Ferndale, Washington: It still takes human minds to run an efficient refinery, and the experts must be *where* they're needed when they're needed.

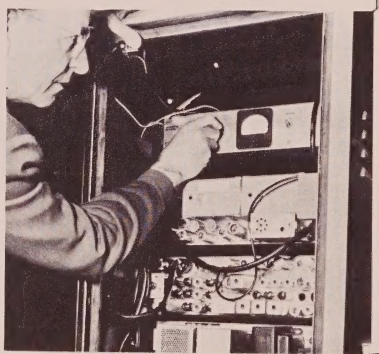
In a plant sprawling over 900 acres, it takes considerable communication just to locate these experts and dispatch them to the place where they are needed. It is a situation tailor-made for radio, and that is why 2-way mobile radio was included as a basic tool when plans were drawn for this $40-million refinery on the shores of Puget Sound.

The design engineers laid out two jobs for radio at Ferndale—dispatching the trucks that shuttle parts and material about the refinery, and keeping close touch with key personnel whose duties take them away from their desks and telephones.

The system necessary to fill these requirements consists of a single fixed station manned 24 hours daily, working into 20 key cars and trucks in four main categories: (1) Maintenance (2) Operating (3) Tool and material delivery, and (4) Emergency.

The number of vehicles varies in each category. There are 2-way radios in the cars and trucks assigned to the superintendent, assistant superintendents and foremen of maintenance; superintend-

Above: After office hours, the Pinkerton guards on duty at the Main Gatehouse use the radio base station to relay messages and maintain contact with watchman in the radio truck.



Left: Elmer W. Hayes, assistant maintenance superintendent and the man behind Ferndale's 2-way radio system, makes a final check on the 450-mc. base station. Transmitter and receiver are located in elevator penthouse.

Below: Clair J. Reese, field clerk in the Maintenance Dep't. has charge of 2-way radio dispatching. Here he calls a radio-equipped truck after receiving a request by phone.

ent, shift foremen and gaugers in the operating department; the parts pickup and boom truck; plant ambulance and safety supervisor's truck.

In daily use, most radio calls concern maintenance, hence the base station dispatching is handled in the Maintenance Shop office by Field Clerk Clair J. Reese. Normal channel for radio calls is from a maintenance foreman or construction supervisor to Reese, who then radio relays the message to the particular mobile unit. Maintenance Superintendent Ted Sullivan estimates the 2-way radio greatly increases dispatching effectiveness by eliminating delays.

Reese's most frequent calls are to Truck 676, the tool and parts pickup, and he mentally charts this truck as it makes regular runs around the refinery because the driver radios his location to the dispatcher at every stop. In this way, he can put his finger on the driver by radio or by telephone if a "hot job" should require fast delivery of materials.

Another frequent user of the radio is Maintenance Foreman Glenn Hannigan, who has charge of maintenance equipment and labor crews. Without radio, Hannigan would be handicapped in switching men from job to job, as he often must do to meet emergencies. Now there is usually a radio truck close by each crew and he can transmit orders directly to the man in charge without having to drive over and give the instruction in person.

Frequently a supervisor needs to locate a particular truck—for instance, the stinger truck which is equipped with a heavy duty boom for lifting. The stinger driver has a 2-way radio and will answer a call to him if he is in the truck. If he is out of the cab, however, he may not hear the call. Then all the other radio vehicles serve as spotters and the first man to see the stinger radios the location back. The locating unit may also notify the stinger driver that there is a radio message waiting for him.

Around a refinery safety and fire prevention are extremely important, and strict procedures are necessary to keep danger at a minimum. Before a welder can ignite his torch, for example, the immediate area must be tested for presence of gas.

Here the mobile radio set-up saves many man-hours each week. The welder telephones to the dispatcher and calls for a gas test. Reese relays the call by radio to the safety truck, which then can check the area and give the go-ahead. If some slower method were used for locating the safety truck, the welder would be delayed longer, at a resulting waste of manpower.

If a fire should ever occur, following a carefully detailed emergency procedure, all radio trucks would go on a listening standby status in order to keep the air channel clear for priority traffic.

At night the base station control shifts from the Maintenance Shop to the Main Gate office, where plant guards take over the dispatching duty. Majority of the night calls are between operating foreman and gaugers, or from the guards to the shift foreman. The guards also use the radio for check-in between the gatehouse and nightwatchmen patrolling the refinery in radio-equipped pickups.

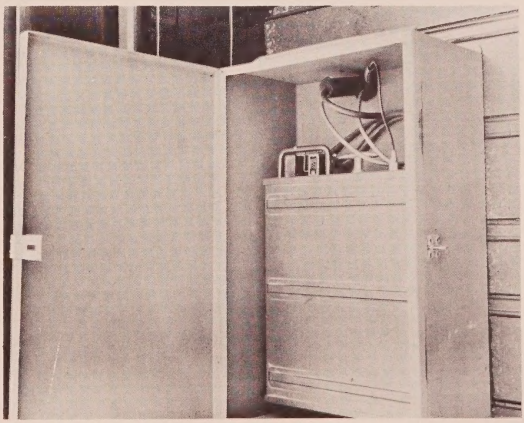
Before ordering the new radio system, Elmer W. Hayes, Assistant Superintendent of Maintenance for General Petroleum, and Harry Tarbell, a Motorola communications engineer, conducted radio propagation tests on the refinery site, and by study of topographic maps predicted the coverage area.

Due to the proximity to the Canadian border—about 8 miles north of the refinery—there was some possibility that a Ferndale radio system operating in the 150 mc. bands might cause interference to Canadian stations. Therefore, in the interest of friendly international relations, General Petroleum elected to utilize the 450 mc. frequency for Ferndale.

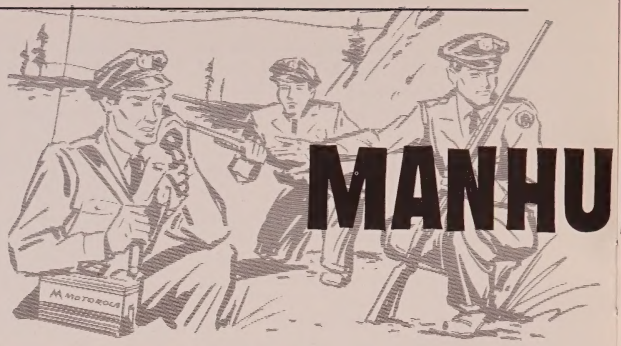
All stations, both mobile and base, (all rated at 18 to 20 watts RF output) are tuned to a common frequency of 451.45 mc., which permits 2-way communication from base to mobiles, as well as mobile to mobile.

For best coverage, the base station and its antenna were placed at the highest spot on the refinery, atop the thermofor catalytic cracker structure. Standing 290 feet above ground, the antenna gives line-of-sight coverage for 12 to 15 miles in all directions—well beyond the usual travel requirements of refinery vehicles, and even including the city of Ferndale. Thus radio contact can be maintained with cars and pickup trucks traveling to and from town.

It is impossible to estimate how much the 2-way radio saves in time and money at Ferndale, since the plant never operated without it. However, Chief Engineer V. M. Stanich has this to say about the radio system: "It is fine for routine work, and absolutely essential in emergencies." » » »



To protect 2-way radios in trucks against weather and cargo damage, General Petroleum houses the UHF transmitter - receivers in heavy, waterproof cabinets.



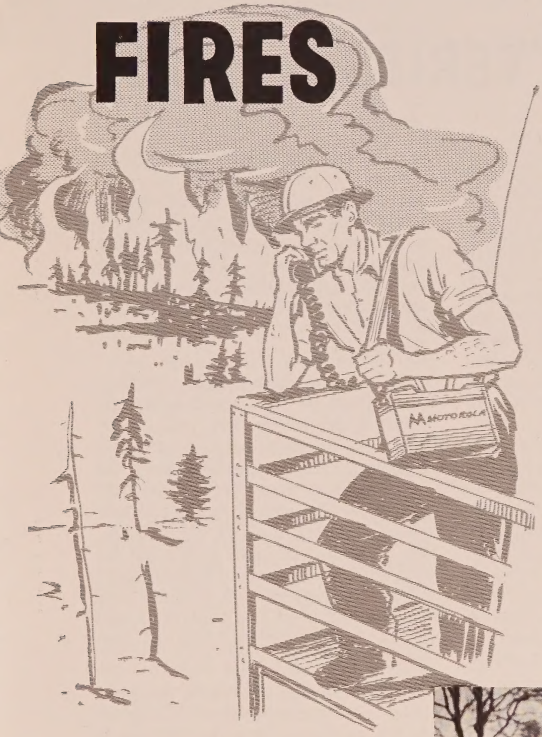
MANHU

The widely publicized Chicago manhunt for the slayer of a policeman last year and the catastrophic forest fires in California were two situations exhibiting a common need—radio communications. In the uninhabited timberlands as in the heavily congested areas in Chicago, Motorola HANDIE-TALKIE portable radiophones help coordinate activities of heroic firefighters and police. The value of radio communications was so great—as vouched for by the men using it—that such an adjective as "indispensable" is not too strong. Who is to say how much greater the fires might have been, or how many more people might have died if there had not been radio communications?

Left, Navy Lt. Robert Brower and Detective James Lynch received instructions from Deputy Commissioner Phillip Breitzke before taking to the air in a U. S. Navy helicopter in an effort to speed the capture of a police killer who was on the loose in Chicago. Communications in the air were maintained with ground forces by means of a Motorola portable radiophone. » » » *(United Press Photo)*

A $35,000 tank wagon, designed especially to fight Santa Monica Mountains brush fires, climbs a steep hill through underbrush. Capt. Richard Williams of the Los Angeles Fire Department directs movements of motorized equipment by means of a portable radiophone.
Modern fire fighting equipment is extremely important in suppressing fires. According to Professor Davis, a modern power plow or tractor equipped with power spray nozzles, two-way radios and portable radiophones, does the work of 50 men in fighting forest fires. Partly for this reason the United States is the world's acknowledged leader in fire control. » » » *(Los Angeles Times Photo)*

NTS and FIRES



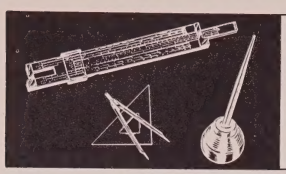
Barney Galusky and Robert B. Mason, U. S. Forestry Rangers, report the status of a smoldering fire from San Marcos Pass via portable radiophone. The worst fire in Santa Barbara County (Calif.) history blackened more than 76,000 acres of valuable watershed before it was fought to a standstill by 2100 firefighters. Much time in making the initial attack on the fire was saved because HANDIE-TALKIE radios were available for communication purposes, Mason said.

The significance of this damage is more easily realized when you consider the statement of a University of Michigan forestry professor, Kenneth P. Davis, that the energy equivalent of a medium size atom bomb is released in 40 acres of burning brush. Each year, there is as much energy wasted in forest fires as would be released by the explosion of 250,000 atom bombs.

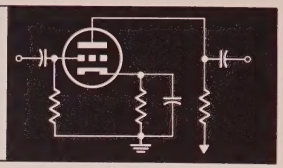
Much credit should be given to employees of the U. S. Forest Service in the California Division of Forestry, volunteers from local fire departments, lumber companies, public utilities, etc., and military personnel who fought this and other devastating fires in California last year.

(INS Photo)

The 64-day state-wide manhunt for the "phantom killer of Kentucky," which took place several years ago was without parallel in the history of that state. As might be expected, much of the activity was coordinated by means of patrol car radio and HANDIE-TALKIE portable radiophones, as squads of troopers patrolled barren and rocky land spotted with woods, cliffs and caves. Col. Charles C. Oldham, commissioner of the Kentucky State Police, led the manhunt. He and some of his men, equipped with Motorola portable radiophones, examined a large scale map during one of the final days of the manhunt. » » »



Technical Notes Section



The primary source of energy for mobile radio service.

STORAGE BATTERIES

USES

Of the endless applications served by the storage battery perhaps none is more familiar than its use in motor vehicles. Especially to users of vehicular two-way radio, the day-to-day functioning of the car battery is of primary importance as it controls to a great degree the reliability and performance of the radio equipment.

The load on the electrical system of automobiles has increased greatly. In addition to the requirements of former years for starting, lighting and ignition, modern cars have more and brighter lights, cigar lighters, heaters, defrosters, fans, direction signals, panel lights, radios, air conditioners and other accessories. During the past 25 years the electrical load of passenger cars has increased from about 7 amperes to over 30 amperes. This trend makes it increasingly important that mobile radio users employ a battery that is certain to have adequate capacity. It is equally important that the electrical charging system be capable of handling these added requirements. Successful mobile operation can be assured only when the car is properly equipped on both counts.

CHARACTERISTICS

The storage battery is essentially an electrochemical device. It consists of two or more connected cells that convert chemical energy into electrical energy. The cell is the unit part of the battery and consists of two dissimilar electrodes immersed in an electrolyte in a suitable container. Examples of electrodes are the copper and zinc plates of a simple primary cell, or the lead and lead dioxide plates of a storage cell. The electrolyte is a water solution of certain acids, alkalies or salts.

A number of different cells are in use, but they may be classified conveniently into two general groups as primary and secondary cells. Primary cells, such as the familiar "dry" cells, convert chemical energy into electrical energy and in so doing become exhausted. Secondary, or storage cells, on the other hand, convert chemical energy into electrical energy by reactions that are essentially reversible, which allows recharging.

CAPACITY

Storage battery capacity is generally expressed in ampere-hours, and is a measure of the quantity of electricity that the battery is able to deliver. Capacity may also be expressed in watt-hours, which is a measure of the energy or ability to do work. The ampere-hour measure is more often used because in nearly all applications the current requirement is the controlling factor. The torque exerted by a motor, the heating of a lamp filament, or the intensity of a field within a solonoid are all proportional to the current.

The ampere-hour capacity and the number of cells of any battery being known, the watt-hour capacity is easily approximated since the nominal voltage of the lead-acid battery is 2 volts per cell.

CHARGING METHODS

Only direct current can be used for charging. If alternating current only is available it must be converted to direct current by means of a synchronous converter, motor-generator, or rectifier.

For bench or shelf charging, there are two basic systems in general use: constant-current and constant-voltage. In the first system, the current is held constant by means of a variable resistance in series with the battery, or by controlling the voltage of the source. The current is maintained at the normal fixed rate by decreasing the resistance as the charge progresses. The specified current is maintained until all cells are gassing freely and then reduced to a much lower rate, known as the finishing rate.

In the constant-voltage method, the voltage is maintained at a constant fixed value per cell. The value of the starting current of a completely discharged battery is much higher than the normal rate and is usually limited to a maximum value. At the end of the charge, the current will have fallen off to less than that of the finishing rate of the constant-current system. The average value of the current is approximately equal to that of the normal rate.

There is also the more common type of system-governed charging which is exemplified by the work of the automotive battery. Charge and discharge are automatic and governed by the design and adjustment of the electrical system. It discharges to start the engine, operate the radio, etc., until a certain engine speed is attained. Then the load is removed from the battery and transferred to the generator which simultaneously is charging the battery. DC generators are conventionally supplied as standard equipment in most vehicles. AC generator-rectifier systems and their voltage-regulators replace the DC generators for higher current capacity at low speeds in many two-way radio applications.

To correct inequalities among cells of a battery, the battery is given what is known as an equalizing charge. This is essentially a pro-

longed charge at the finishing rate or less.

Under certain conditions it may be found that the ampere-hour capacity of a battery is insufficient for a full day's work. In that event, it may be charged at a high rate for a short period of time, usually at midday. Such a charge is called a boosting charge. The 'fast charge' provided for automotive batteries furnish what is in effect a boosting charge.

A trickle charge is a continuous charge at a low rate sufficient to compensate for the internal losses of the battery and sufficient to maintain the battery at full charge.

CARE AND MAINTENANCE

Given proper care and maintenance most recognized automotive batteries will give satisfactory service. This includes care not only for the battery itself but also for the charging system as well.

One method of determining the state of charge of the battery is by hydrometer readings. Fully charged, the specific gravity will range from 1.260 to 1.280. When discharged, the specific gravity will range from 1.140 to 1.160.

Perhaps a more convenient method for testing automotive batteries is by use of an expanded scale voltmeter. Meters available commercially are generally designed to give not only the actual voltage reading but also the percent of charge. They can quickly and easily determine the state of charge and also provide a complete test of other factors affecting the life or condition of a battery. Such instruments can be used to locate faulty cables, identify short circuits, test the battery under load, and also to test the voltage regulator.

An essential part of ordinary care is the addition of pure water as necessary to keep the plates well covered. The water should be added after hydrometer tests are taken since the water, being less dense than the electrolyte, tends to remain on top and will give a false indication of specific gravity. Distilled water is much to be preferred for this purpose.

Another essential for satisfactory operation is cleanliness. Water and electrolyte which has been spilled on the top of the battery should be wiped off. A rag moistened with dilute ammonia or a solution of baking soda will neutralize the acid on the top of the battery.

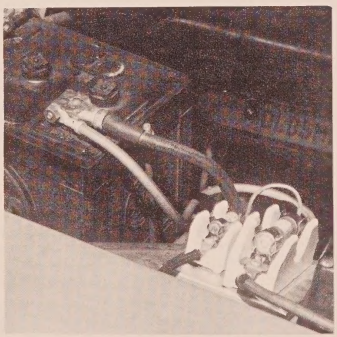
TROUBLE SOURCES

As a result of statistical studies, the reasons for battery wear are fairly well recognized. The following are some of the more common trouble sources which cause the period of useful service to be shortened.

Overcharging: Overcharging can produce corrosion and excessive gassing which loosens active material in the plates. Overcharging also causes excessive increases in the temperature of the battery, which is destructive to both plates and separators. Overcharging accompanied by excessive gassing results in a needless loss of water, requiring constant refilling to maintain the proper level of electrolyte.

Undercharging: Consistant undercharging of the battery results in a gradual running down of the cells. This is indicated by progressively lower values of specific gravity and by a tendency of the plates to become somewhat lighter in color. Complete battery failure can result due to buckled or sulphated plates.

Charging System: In normal operation of a car equipped with a conventional generator, the battery should begin to charge when a speed of 12 to 15 mph. has been reached. Certain heavy-duty DC generators and AC generator-rectifier systems may reach full current capacity at these low speeds. Unless the generator cuts in at the proper speed the battery will not receive its normal amount of charge. There is also the possibility of grounded circuits, which drain the battery and keep it in a more or less discharged condition. The charging system is always provided with some type of regulation which prevents the battery from receiving excessive currents when the car is operated at high speeds.



Power connections to the radio equipment should always be made directly to the battery source as illustrated, not to the generator or voltage relay.

Corroded Terminals: The products of corrosion are non-conducting substances which form a layer between the terminal of the battery and the clamp connector. This corrosion will reduce the charging current supplied to the battery and will make the resistance too great for the large currents required to start the engine and maintain the proper voltage for the two-way radio and other electrical devices. The products of corrosion should be removed and the parts cleaned with a dilute solution of ammonia and then should be covered with light grease or vaseline.

Short Circuits: Short circuits within the cells may be caused by a breakdown of one or more of the separators between the positive and negative plates; by accumulation of sediment in the bottom of the case; or, by the formation of a tree-like structure of lead from the positive to the negative plates. The evidence of short circuiting are: (1) continued low reading of specific gravity even though the battery is receiving normal charge; (2) rapid loss of capacity after a full charge, and (3) low open-circuit voltage.

Worn-Out Plates: Worn-out plates are ordinarily detected by a decrease in capacity in a battery receiving adequate charge. The specific gravity of the electrolyte may rise to the usual value, but the capacity on discharge is below normal. Fifty to sixty per cent of the rated capacity is usually taken as the end of service life.

Freezing: Under ordinary conditions, freezing will only occur when batteries are in a discharged condition. Freezing then may destroy the plates.

Sulfation: The word "sulfation" is used in many senses. In general, it means the formation of lead sulfate on the surface and in the pores of the active material of the plates. Most commonly it applies to the large crystals or crusts of lead sulfate that may form on the plates due to neglect or misuse. Excessive sulfation can be avoided with reasonable care. » » »

Service Hints and Shop Notes

PARTS DEPT. MOVES

The new address of the Chicago Parts and Service Department of Motorola Communications and Electronics Inc. is:

Parts and Service Department
Motorola Communications
and Electronics Inc.
589 East Illinois Street
Chicago 11, Illinois
Telephone: MIchigan 2-1252
TWX: CG 2570

ALKALINE BATTERIES

Motorola 6/12 volt mobile radio equipment is designed to operate from conventional 6 and 12 volt lead-acid storage type batteries. The voltage regulator settings required for higher potential alkaline type batteries exceeds the design center for conventional equipment and will shorten tube life expectancy accordingly. In general, there is no practical modification to enable the use of alkaline type batteries with Motorola equipment. Dropping resistors create excessive power loss, and special converters are not only expensive but also decrease system reliability. » » »

450 MC. MOBILE ANTENNAS

Propagation characteristics in the 450-470 mc. frequency range require that mobile antennas be mounted on or above the roof of the vehicle. When a bumper-mount antenna is employed, the radiator element should be at or above the same level as the vehicle rooftop. Rooftop type antennas should not be mounted on trunk covers or cowl sections. »

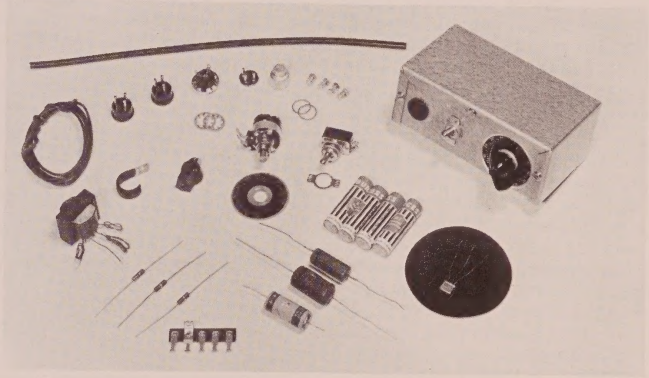
801 & 801A CRYSTALS

The D14A type crystal replaces the 801 or 801A crystal in *12 volt* receivers. Since the D14A has a 12 volt heater element, it should be placed directly across the 12 volt source by jumpering the 15 ohm dropping resistor in series with the crystal in *12 volt* receivers. The D14 type crystal is a direct replacement for 801 or 801A crystals in *6 volt* receivers only. » » »

12-to-6 VDC CONVERTER

The life of the vibrator driving contacts in the TU179 Converter

TRANSISTORIZED TONE GENERATOR KIT



Now any service technician can quickly become acquainted with the handling and use of transistors by building a highly useful transistorized tone generator from a new Motorola kit. Kits are available through Motorola Service Stations for $12.00, plus applicable taxes and shipping charges, subject to change without notice. All kits are complete with detailed assembly and use instructions. This offer will be withdrawn upon depletion of current stock.

USEFUL—Not a gadget but a full-fledged test instrument generating a stable audio tone of approximately 1,000 cycles. Can be used as an aid in properly adjusting I.D.C. of the transmitter and in measuring modulation sensitivity. The tone generator can also be used in conjunction with the P-8501-A test set for receiver audio testing. Plugs into the test set or into a standard four-pin microphone plug.

EDUCATIONAL—Provides experience on the use and handling of transistors. Demonstrates transistor circuitry. Allows you to observe and check transistor operation.

COMPLETE—The kit is complete with assembly and operating instructions. Includes batteries, controls, Motorola PNP junction transistor, and all other component parts.

(part of the TA142 and TA187 12-to-6 VDC Converter Assemblies) can be further extended by replacing the 0.5 microfarad paper capacitor connected between pin #4 of each of the two vibrator sockets with a 25 microfarad electrolytic capacitor (Motorola Part No. 23K834588). This improvement was incorporated in equipment shipped after March 1956. » » »

TOOL CARTS SAVE STEPS

The right tools at the right place—that's the story behind a recent innovation put in use at the City of Portland, Ore., radio shop. There, each of seven radio technicians is now provided with an individual tool cart, fully equipped with lamp, vise, soldering iron, wrenches and all the other hand tools used for installing and servicing the city's 400 two-way radio units.

Carts are on casters and roll easily wherever the technician may be working—in the mobile shop, to workbenches or into the screened testing booths. It is planned to load them into service trucks for use at remote installations such as new fire stations and the mountain-top main base station site.

The carts are saving technicians much time and a great many steps daily, reports Temple V. Ehmsen, chief of the Bureau of Communications and Electronics for the city.

Since the tools are the responsibility of the individual radio man, each has his equipment color-coded for identification. Each cart carries a retractable reel on the rear side for its AC power cord, feeding multiple outlets for the lamp, soldering guns, VTVM and electric drill.

Similar carts carry the shop's two Motorola frequency monitors used for setting the hundreds of Motorola 2-way transmitters on any of five 150 mc frequencies selected. For zeroing the mobile discriminators, the technician has a 25 foot control cable extension by which he can key any of the five remote base station transmitters simply by pressing a push-button. » » »

City of Portland's seven radio technicians each have own tools and cart, with each man responsible for his own "shop". Carts at left and right carry Motorola frequency monitors.

NEW CRYSTAL OVENS

A new type crystal oven, applicable to all transmitter and receiver crystals having a single-crystal oven unit, provides thermostatically controlled frequency stability of ±.0005% for all crystals, regardless of frequency band. Presently being supplied with current equipment, the improved oven unit is also available for replacement crystals as well. Crystal assemblies containing the new oven are recognized by the distinctive gold-colored anodized finish on the oven exterior, and by the assembly part number which starts with the letter "R". Earlier units are designated by the letter "D". In the future, replacement parts orders for the "D" type crystal assemblies will be filled by the current and corresponding "R" versions. For example: type R03 will replace type D03, type RM10 will replace type DM10, etc. Exceptions: type RM16 replaces type D01, type RM17 replaces type D31, and type RN3 replaces type D34. »

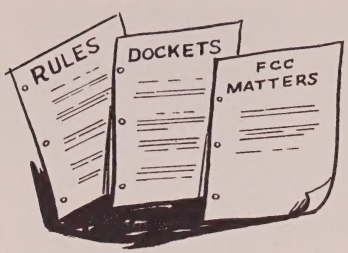
CRYSTAL ORDERING PROCEDURE

A faster, more efficient method of servicing crystals has been initiated to provide better service for Motorola customers. Crystals are manufactured at the main Chicago plant, where new facilities have been added to enable expedited service. Customers who would normally contact the Chicago Parts and Service Department can now gain an advantage in time by transacting their crystal business directly with the Crystal Service Dept., 916 Kilbourn Ave., Chicago 51, Illinois. Customers who would normally contact the Motorola Parts and Service Depots at San Mateo, Calif., and Dallas, Texas should continue to transact their crystal business at these depots.

New stamped and addressed forms are available to provide this faster service. The following information should accompany each crystal order:

1. Crystal type
2. Operating frequency of the unit in which crystal is to be installed
3. Crystal (fundamental) frequency
4. Complete model number of the unit in which the crystal will be used.

Return parts orders should be accompanied by Motorola Return Parts Tags properly filled out and relating the return, if for credit, with a factory order or invoice number. These tags are available from any Motorola Parts and Service Depot. » » »



F. C. C. BULLETINS

Excerpts from publications of and about the Federal Communications Commission

RESTRICTED RADIATION

The FCC has adopted a partial revision of Part 15 of its Rules which concerns the regulation of restricted and incidental radiation devices in order to avoid their interfering with authorized radio services. The amendments include general rules applicable to the operation of such devices and rules specifically applicable to incidental radiation devices and radio receivers.

Concerning incidental radiation devices (i.e., devices which radiate rf energy during the course of their operation, although not designed intentionally to do so, such as electric motors, automotive ignition systems, etc.), the Commission has adopted a simple rule to the effect that "—the operation of incidental radiation devices must not cause harmful interference, and where they do cause harmful interference, the operators of the particular devices must promptly take steps to eliminate the interference."

As to radio receivers, the Commission pointed out that the rules "will be applicable to all receivers operating in the 30 to 890 mc band that are manufactured after May 1, 1956" (this date was later extended to October 1, 1956). However, after February 1, the operator of any receiver, "—regardless of tuning range, date of manufacture, or of certification, which causes harmful interference, shall promptly take steps to eliminate the harmful interference."

For receivers manufactured after Oct. 1, the rules require that each such receiver be certified by the manufacturer as to compliance with the Commission's regulations and have attached to it a seal to that effect. The seal will serve to indicate to the prospective customer that the receiver complies with the Commission's regulations. Compliance by television receivers with the radiation limits is deferred for a specified period. » » »

RADIO FOR AIR TRAFFIC SURVEYS

The FCC has finalized proposed rule-making to permit automobile clubs operating in the automobile emergency radio service to use their licensed facilities, on a secondary basis, to observe and report traffic conditions from the air, effective March 15. Mobile units aboard aircraft are permitted the use of frequencies 452.55 and 457.55 mc only for this purpose. »

CITIZENS RADIO FOR TRAFFIC LIGHT CONTROL

In two separate but similar instances recently, the FCC warned civic heads of the inadvisability of using Citizens Band frequencies to control traffic lights in emergency situations. Applications for such frequencies from widely separated Jackson, Michigan and Tucson, Arizona were answered by identical letters cautioning that all "citizens band" frequencies are shared and therefore subject to mutual interference. The Commission pointed out that the Citizens Service "is not recommended for any use involving the transmission of signals or communications directly affecting public safety or the protection of important property." Explaining that the Rules governing the Citizens Radio Service do not preclude the granting of such an authorization, the letter went on to underline the limitations to operation in this service. The Commission did not recommend an alternative service.

FREQUENCY COORDINATION FOR TRUCKERS

An American Trucking Association Communications Committee has been set up which will assume the task of officially coordinating frequencies across the nation for "carriers of property" in the Motor Carrier Radio Service. Beginning March 1, ATA frequency recommendations will accompany all property carrier's radio applications to the FCC.

The recognition to be given to the ATA group will be similar to that presently given to frequency co-ordinators such as the National Petroleum Radio Frequency Coordinating Association, the National Committee for Utilities Radio, the Associated Police Communications Officers and other groups. » » »

McCONNAUGHEY REDESIGNATED FCC CHAIRMAN

The White House announced the redesignation of George C. McConnaughey as Chairman of the FCC. His appointment continues to June 30, 1957, when his present term as a Commissioner ends. Mr. McConnaughey has been Chairman of the Commission since October 4, 1954. » » »

NEW PRODUCTS

TRANSISTORIZED

Dynamic microphone for mobile installations

When radio men anywhere think of the best microphone quality, they invariably think in terms of dynamic characteristics. Until now, the true moving-coil "broadcast-type" microphone was limited, in the land mobile services, to fixed station applications.

The Motorola transistorized dynamic microphone is designed specifically for *mobile* installations. An important new "plus factor" of "TWIN-V" Radiophones, the unit provides unprecedented mobile transmission clarity — comparable to that of the best base station. The marked improvement in message intelligibility effectively increases communications range.

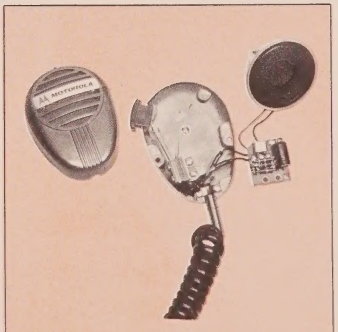
A press-to-talk microphone in the familiar palm-size case, the unit utilizes a moving-coil dynamic element which provides remarkably clear, crisp voice reproduction. A built-in transistor preamplifier boosts the output to provide proper transmitter audio input level for mobile installations. Mounted on a tiny PLA-cir printed chassis inside the microphone case, the preamplifier draws its power from the standard transmitter "talking current" supply. It is directly interchangeable with Motorola carbon microphones, enabling further addition to the superior communications quality of earlier Motorola "Research" Line mobile units. The unit is dust-proof, splash-proof and housed in an all-metal case. It is ruggedly constructed to provide long dependable service.

Extensive testing in the laboratory and in the field have proved the unquestionable superiority of the Motorola transistorized dynamic microphone over any other known type of mobile microphone. Other types of microphone elements have been used in attempts to improve mobile transmission quality, but the dynamic element is the only quality element which is inherently immune to the electro-magnetic noise radiations in mobile installations.

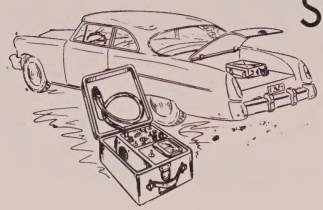
Quality microphones with low level outputs have long been used in fixed stations in conjunction with a preamplifier on the transmitter or in the remote control console. In mobile installations, however, this approach often results in excessive amplification of noise picked up by the microphone element and cable. Built-in transistor preamplifiers have been used with other types of microphone elements to alleviate this condition. However, *only* the Motorola transistorized *dynamic* microphone couples the inherent immunity of a dynamic element with a built-in transistor preamplifier to overcome the electro-magnetic noise pickup problem in mobile installations.

This new development is also available as a dual-purpose version SPEAKER-MIKE which doubles as a speaker and as a dynamic microphone. The SPEAKER-MIKE utilizes the same dynamic element and built-in transistor amplifier, and is contained in the same all-metal palm-size case as the dynamic microphone. It functions as a communications-type loudspeaker when not in use as a microphone. The practicality of this new unit is generally limited to special applications best utilizing its unique features. These applications will probably grow with experience in actual useage. Normally held in the hand as a microphone while both talking and listening, it can be conveniently dash-mounted or held near the ear to overcome ambient noise or provide low volume semi-private reception.

You can have either of these outstanding microphones as *optional* equipment with new "TWIN-V" radiophones, or as replacements for carbon microphones in existing Motorola mobile installations. The transistorized dynamic microphone is directly interchangeable with Motorola carbon models now in use. A simple modification kit adapts existing trunk-mount installations to use the SPEAKER-MIKE version. » » »



Transistorized dynamic microphone with moving coil element and transistor preamplifier removed from case.



System Maintenance of Two-way Radio

by
JOSEPH JATIS
Assistant to National Service Manager
Motorola, Inc.

The continuous operation of an efficient, dependable and reliable radio communications system requires regular attention to maintenance. It may be true that some radio communication systems will operate with very little attention; but to insure continued peak performance of radio communications equipment, it is necessary that a program be developed for periodic checking or testing, of the entire system. Any preventive maintenance program, to be successful, must be based on "system maintenance".

DEFINITION

What do we mean by "system maintenance?" The dictionary definition of a system is an "an assemblage of objects, united by some form of regular interaction or interdependence—an organized whole." What could be more descriptive of a radio communications system? System maintenance then, means the inspection and maintenance of all the units constituting the complete whole, in a systematic and planned orderly fashion.

All radio communications systems include integrated assemblages. The three major factors in a radio communications system which require attention are:

(1) The primary power source.
(2) The unit assemblages.
(3) The antenna system.

Any successful maintenance program must include the entire system.

PRIMARY POWER

Contrary to popular belief, automobile batteries seldom go dead without warning. They usually fail after a long period of undercharging or overcharging, lack of water, poor connections or old age, with many indications of the approaching end. A fully charged battery may show a measured voltage of approximately 6.4 volts or 12.8 volts as the case may be. An old sulphated or undercharged battery may show voltages of 6 volts or even less. These are **battery terminal voltages, not** the voltage present at the units. The terminal voltage at the units in the trunk of the car will probably be 0.5 to 0.7 volts lower when a transmit current of about 40 to 60 amperes is being drawn. A good method of checking primary power trouble is to measure battery voltage both at the terminals of the battery and at the equipment. A drop of more than 0.7 volts measured at the units would point to troubles in the primary circuit—cable, fuse block, relay or chassis return. Such a voltage drop is excessive and should be investigated fully. A few of the typical troubles encountered would be:

Relay contacts— worn out, requiring replacement.

Fuses— increasing resistance. Check and replace if voltage drop exceeds 0.1 volt.

Connections— loose as a result of vibration. Tighten or resolder.

Fuse Holders— loose because of vibration— poor contact because of acid corrosion and/or accumulation of oil and dirt. Clean contacts, tighten or replace.

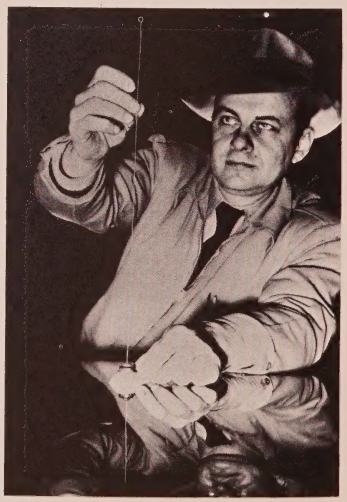
Keeping voltage drops to a minimum in a primary circuit is very essential to good system operation. The same rules apply to other sources of power. Dry batteries especially must be checked under full load. AC primary voltages are often too high as well as too low.

UNIT ASSEMBLAGES

These include transmitter, receiver, power supply, etc. In maintaining unit assemblies the secret lies in knowing what to do and **what to leave alone.** Very few adjustments need to be made regularly in transmitter and receiver units. To catch a maximum number of incipient troubles, the technician must use his eyes, his ears, his sense of touch, and meter measurements, as well as his good judgement and past experience. Basically, four types of observation are required:

(1) **Listening Tests**— An experienced technician can often detect warnings of impending trouble by noting the audio quality, the noise background and the squelch operation in relation to the settings of the volume and squelch controls. He will know the normal signal level he should obtain at given locations with selected stations in a particular system.

(2) **Visual Inspections**— look for loose bolts, screws and clamps, worn microphone cords, burned out pilot lights, arcing at any point, loose or broken components, burned resistors, or loose connections. A good visual inspection not only is a means of quickly locating the source of trouble, but may prevent more serious trouble from developing later on.



A visual check of mobile antenna mount, cable, and connectors should be made periodically.

(3) **Touch**— the fingers are good detectors of improper temperature conditions. Fuses, fuse holders, crystal ovens, transformers and relay coils which are too hot mean trouble, as likewise a cold crystal oven or tube that should normally be warm.

(4) **Meter measurements**— actual quantitive measurements of filament and plate voltages, grid and plate currents, power output, frequency and deviation have no substitute; their meaning is definite. Experience will indicate to what degree variation can be tolerated.

ANTENNAS

Visual check of antenna, line and tower lights, mobile antenna mount, cable, and connectors should be made periodically, as well as a meter check to find any open or shorted lines or high standing wave ratios. Remember that the antenna must efficiently radiate the power developed in the transmitter chassis and also transfer to the receiver the minute voltages picked up from the distant transmitter to produce a good audible signal.

Some radio communications systems have been operating with no safety factor at all, and the slightest drop-off results in a trouble call. On the other hand, many systems have quite an adequate safety factor and these systems sometimes deteriorate to an amazing extent before complaints arise. The technician should know to what extent he can allow transmitter power output and receiver sensitivity to drop without seriously degrading system operation.

NETTING

Netting of receivers and transmitters in any system is more important than usually realized. The term "netting" means that all receivers and transmitters in a given system are aligned on the same frequency. With modern selectivity requirements, it is more than ever necessary to tune every receiver **exactly** to the station it must receive. Careful "netting" in an integrated system is a first order requirement and will eliminate a prime cause of poor system performance.

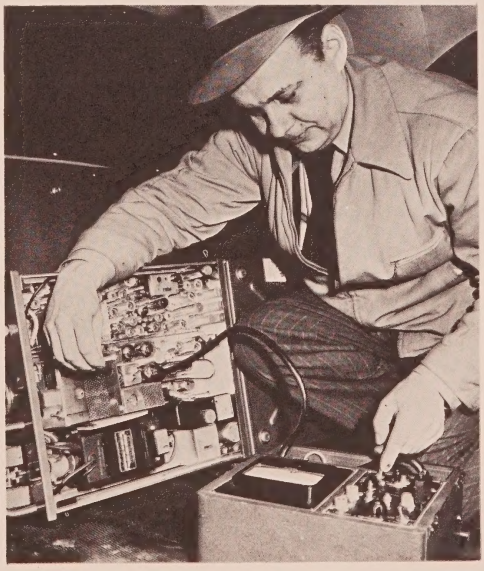
Frequent checks of transmitter deviation will also do much to improve system operation. Frequency and deviation checks are more important from a system operation standpoint than the twice-yearly F. C. C. regulations seem to indicate. All transmitters should be checked for a full ± 15 kc. for standard channel and ± 5 kc. for split channel operation. Underdeviation does not develop the full advantages of frequency modulation. A good rule to follow is to check performance frequently and make adjustments only when necessary. Adjust nothing without meters and signals to indicate actual conditions.

CHECK LIST

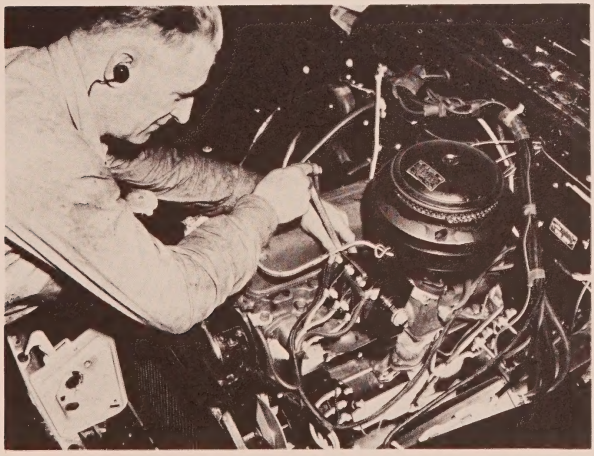
Good preventive maintenance requires a complete system check at **least** every three months. The following items should be part of any preventive maintenance routine:

(1) Clean and dust thoroughly.
(2) Check primary voltage circuits.
(3) Measure sensitivity of receivers.
(4) Check meter readings at the metering positions of transmitters and receivers
(5) Measure power output of transmitters.
(6) Check audio output of receivers and audio input to transmitters.
(7) Check operation of all relays.
(8) Check and adjust frequency netting of the entire system.
(9) Measure frequency and deviation of transmitters.
(10) Check all accessories; control head, cables, microphones, pilot lights, etc.
(11) Check the antenna system.
(12) Check and adjust remote control levels.
(13) Check power supply output voltages.
(14) Make an operational listening test of transmission and reception.

Right, Good test equipment is essential. It saves time and enables the serviceman to do a better job.



Below, Primary Power Sources are the first check points in preventive maintenance procedures.



Planning a Propagation Path

With only a little help from his Motorola microwave engineer, a qualified engineer can conduct his own microwave propagation path survey. Here, in a brief summary, are some of the important points to keep in mind.

Your propagation path survey can provide you with three important sets of facts:

1. facts required to determine the cost of the system
2. facts required by the Federal Communications Commission for licensing
3. facts to assure you of reliable microwave propagation

Preliminary "Paper" Survey

This preliminary survey helps you determine the number of repeaters required, and the approximate tower height of each station. To make this survey, you'll want both topographical maps to show you the contours on the tentative path lines and county road maps to provide recent road information and indicate local man-made structures.

If topographical maps are not available, it will be necessary to take elevation readings by reconnaissance in the general areas in which you plan to locate the stations.

United States Geological Survey maps of either the 7.5 or 15 minute series with contour intervals of 5, 10 and 20 feet are excellent for this purpose. County road maps can usually be obtained from the office of the county engineer. While these road maps may contain some inaccuracies, they are sometimes laid out on the USGS polyconic grid and can be matched with a fair assurance that the data plotted will be correct.

Other sources of maps which can provide helpful information are the state geological survey group, U. S. Army Corps of Engineers, TVA, and the Army Map Service. Sometimes it is possible to obtain contour maps from the engineering or forestry departments of universities and colleges.

Determining Tower Heights

After you have obtained the best maps available, the next step is to plot the location of each fixed station on the map. Now you are ready to select the intermediate relay points by evaluating the topographical features and the accessibility of the sites by all-weather roads. Several alternative relay sites are usually selected at the same time.

The elevation of the prominent points along the proposed path can be plotted on an earth curvature profile graph. By assuming a reasonable obstruction height and allowing for ½ Fresnel Zone plus 10 feet, the approximate tower heights can be quickly established.

After profiles of all tentative paths have been drawn, the path permitting minimum tower height is usually selected as the most desirable. Tower heights in excess of 300 feet are normally rejected, as the added cost for the special towers and reflectors may exceed the cost of an additional repeater station.

Nine-Point Check on Sites

Before beginning the actual elevation survey to refine the information obtained from the maps, it is important to inspect all tentative sites to determine their desirability and to confirm their elevations. This nine-point check will provide all the information required for your final decision.

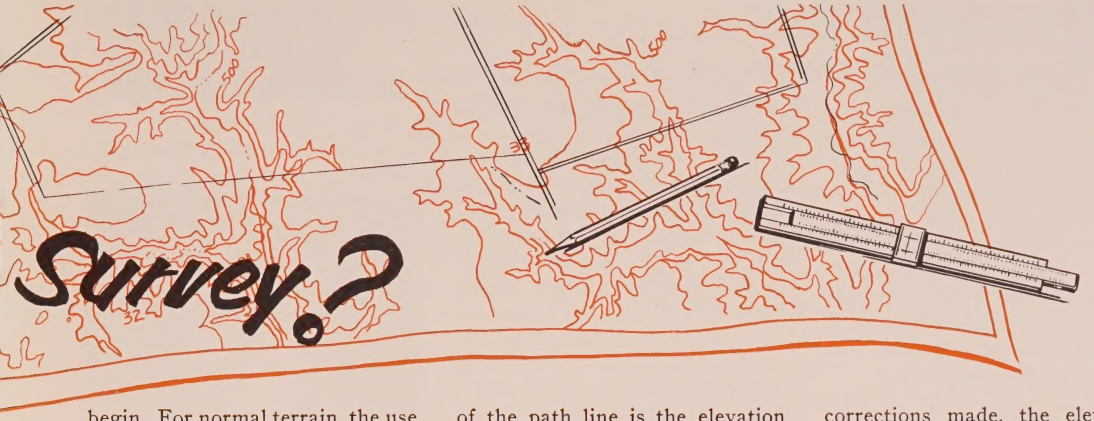
1. Accessibility of all-weather roads
2. Availability of power
3. Soil Conditions
4. Contour characteristics of the site
5. Obstructions at the site which must be removed
6. Availability and cost of land
7. Availability of suitable alternative locations
8. Zoning regulations
9. CAA regulations regarding airports and airlanes

The availability of good roads and power service is very important in determining the best site. The added cost of building a new road or installing a long power line can substantially increase the cost of construction.

Poor soil conditions, irregular land, or obstructions can also boost construction costs. Blasting on rocky soil or piling, excavating and forming in swampy or marshy soil can be very expensive.

Elevation Surveying

Once the tentative site locations have been selected and inspected, the elevation survey can



begin. For normal terrain, the use of altimeters provides sufficient accuracy and is the most practical method. In extremely rough territory, visual methods can often be utilized. In some cases it may be necessary to resort to aerial surveys.

For most elevation surveys, two altimeters are required. At the beginning of the survey, both altimeters are adjusted to the known elevation at a bench mark location. One altimeter is kept at this location, and temperature and elevation readings are taken and recorded at five-minute intervals. The other altimeter is used to obtain temperature and elevation recordings at any point where the path line crosses possible critical areas or obstructions. These points can often be reached by automobile. The highest elevation within .01 mile of either side of the path line is the elevation that should be recorded and noted on the map.

The height of any obstruction such as trees or buildings should be recorded at each point where a reading is taken. These heights can often be estimated. However, if there is any doubt about the height at critical points, a teleheight or transit should be used.

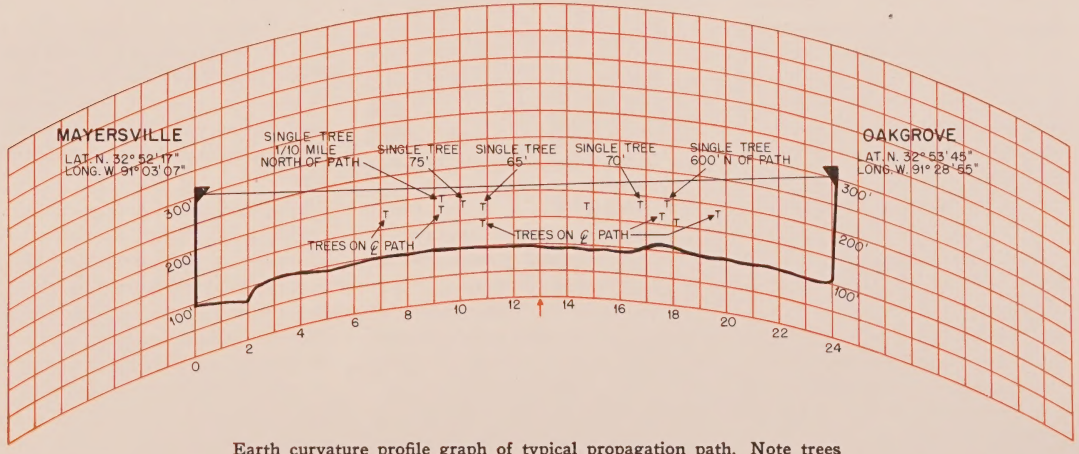
When the series of readings has been completed, the altimeter used to check the elevations along the path line should be returned to the bench mark location and checked with the fixed altimeter. If the readings of the two instruments are within five feet of each other, the data obtained can be considered sufficiently accurate.

One Final Caution

After the measurements have been assembled and the required corrections made, the elevation and obstruction heights are plotted on an earth curvature profile graph. By allowing for the required Fresnel Zone clearance, accurate tower heights can be determined. With the facts provided by this survey, a quotation on the proposed microwave system can be prepared.

If a thorough propagation survey has not been conducted, quotations on the proposed system are likely to be very inaccurate. If the survey itself is inaccurate, system performance can be jeopardized.

One final word of advice . . . . your Motorola microwave engineer is prepared to conduct a comprehensive survey for you. If you plan to conduct your own survey, it will pay you to consult him first; his counsel can save you time and money. » » »



Earth curvature profile graph of typical propagation path. Note trees and other obstructions are marked on graph.

TRANSMISSIONS . . .

. . . On Communications Topics

Save On Fire Insurance

Cities using two-way radio for fire headquarters-to-field rig communications will benefit by lower insurance rates. The National Board of Fire Underwriters is revising its rating schedule weighting for cities to reflect such use, it was revealed at the 60th annual meeting of the International Municipal Signal Association.

For years, fire insurance rates for cities have been partially based on the "rating" survey performed by an insurance board of underwriters covering water supply, building restrictions, fire department apparatus and organization, fire alarm facilities and other factors, but until now no recognized weight was assigned to the headquarters-field rig communications.

No Interference Here

An example of how atmospheric conditions can play strange tricks with two-way radio communications is the following story, reported recently in the Seattle Times.

A member of the King County (State of Washington) Sheriff's Office was driving near Dry Lake, Nevada recently, returning a prisoner to Seattle. Without reason, he turned on the receiver in his car and was astonished to hear his own dispatcher calling the car number to which he normally would respond if he were patrolling King County. He lifted the microphone from the dashboard and answered the call. Surprisingly enough, his reply carried loud and clear all the way to Seattle.

"Where are you," asked the mystified dispatcher in the sheriff's office atop the County-City Building in Seattle.

"In Nevada," replied the detective, "but I'll be seeing you all in a couple of days."

The distance from Dry Lake to Seattle is in the neighborhood of 600 miles. » » »

New Appointments For Motorola's Semi-Conductor Division

Two major personnel appointments for Motorola's Semi-Conductor Division in Phoenix, Arizona, have been announced by Daniel E. Noble, vice president of Motorola, Inc. Dr. W. R. Sittner was named associate director of research and development. Dr. W. E. Taylor was made chief engineer of the materials research department.

In his new capacity Sittner will be responsible for administration of research and development contracts between the Semi-conductor Division and various government agencies. His other duties will include fiscal, budgeting and planning functions and technical assistance on special problems.

Dr. W. R. Sittner

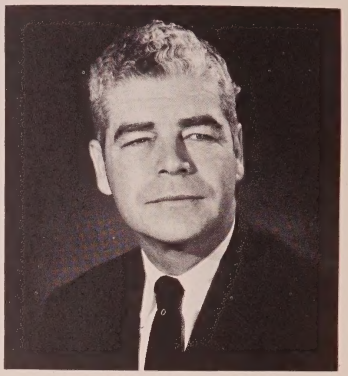
Dr. W. E. Taylor

Dr. Sittner has a broad background of experience in research, development and production of semi-conductor devices.

Dr. Taylor has been associated with the Motorola semi-conductor program since its inception in 1952 as senior project leader of materials research. He formerly was with the Oak Ridge National Laboratory as a metallurgist. » »

JONES DIRECTS ENGINEERING FOR MOTOROLA'S NATIONAL DEFENSE DEPT.

Appointment of Arthur H. Jones as director of engineering of Motorola's National Defense Department, has recently been announced by Daniel E. Noble, vice president in charge of the Company's Communications & Electronics Division.



Arthur H. Jones

Mr. Jones was formerly vice president for engineering of Frank C. Brown and Company, Inc., of New York and Hartford. He was concurrently consultant to the Research and Development Board of the office of the Secretary of Defense and to the Operations Research Office of the John Hopkins University.

In World War II, Jones, then a colonel, was assigned to General Omar Bradley's First Army Staff as electronics officer. During his period of service, he was awarded the Bronze Star and the Legion of Merit.

His educational background includes a BS degree in Electrical Engineering from Princeton University, and advanced work in electronics at Harvard University and the Massachusetts Institute of Technology. He is a member of the Institute of Radio Engineers and the Armed Forces Communications and Electronics Association. » » »

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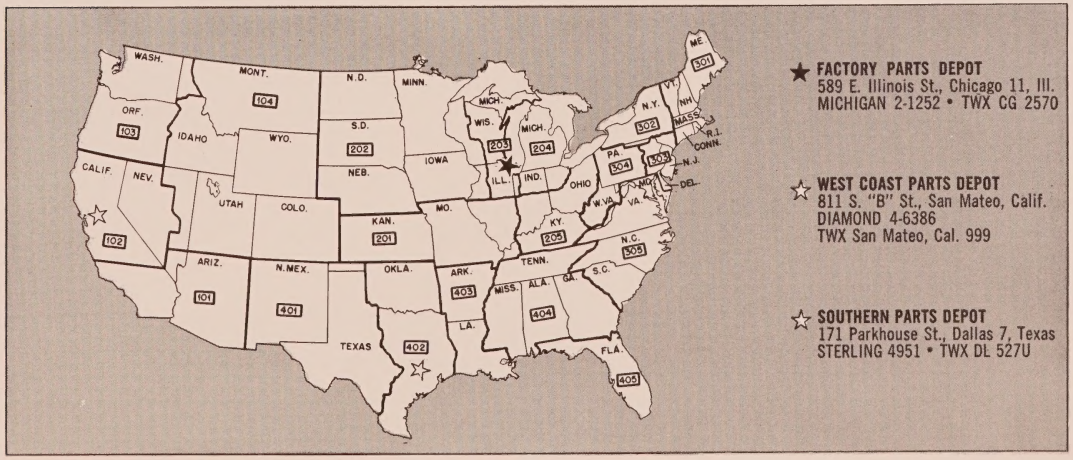

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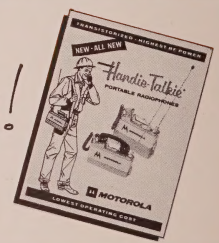

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